Environmental and Energy Study Institute
...advancing innovative solutions!
Carol Werner
Executive Director

FACT SHEET

Jobs from Renewable Energy and Energy Efficiency

October 22, 2008

National

- According to research by Roger Bezdek for the American Solar Energy Society (ASES), the renewable energy (RE) and energy efficiency (EE) industries created a total of 8.5 million jobs (direct and indirect) in 2006; 450,000 jobs in RE and 8 million jobs in EE throughout the United States. As many as 1 out of 4 workers in the United States will be working in RE or EE industries by 2030. The 40 million jobs are not just engineering-related, but also include millions of new jobs in manufacturing, construction, accounting, and management.[i]
- The Union of Concerned Scientists (UCS) estimates that a national Renewable Portfolio Standard (RPS) of 20% by 2020 would create 185,000 new jobs from RE development, add $25.6 billion in income to farmers, ranchers, and rural landowners and save consumers $10.5 billion in lower electricity and natural gas bills by 2020.[ii]
- A report from the Renewable and Appropriate Energy Laboratory in Berkeley found that RE creates more jobs per megawatt (MW) of power installed, per unit of energy produced, and per dollar of investment, than the fossil fuel energy-based sector.[iii]
- The Center for American Progress (CAP) and the Political Economy Research Institute (PERI) project a $100 billion green investment package over two years would create nearly four times more jobs than spending the same amount of money within the oil industry, and would reduce the unemployment rate to 4.4 % over two years.[iv]
- A report from the US Council of Mayors projects that 4.2 million new green jobs can be added to the US economy by 2038.[v]

States

- A study by the IC2 Institute reports that Texas could add 123,000 new high-wage jobs by 2020 to its economy by actively moving toward solar power.[vi]
- A recent study by the American Council for an Energy-Efficient Economy (ACEEE) reports that by adopting energy efficient strategies Florida will save $28 billion, offset the state's entire future growth in electric demand by 2023, and create more than 14,000 jobs by 2023.[vii]
- Based on the ACEEE report, Florida recently adopted a series of rigorous clean energy policies, including a dramatic reduction in greenhouse gas emissions, a Renewable Portfolio Standard (RPS) requiring 20% renewable electricity generation by 2020, and the California motor vehicle emission standards.[viii]
- According to Environment California, the impact of meeting California's previously enacted RPS of 20% by 2017 would create an estimated 119,000 person-years of employment at an average salary of $40,000. The California RPS has now been accelerated to 20% by 2010.[ix]
- Environment California also forecasts that California's Million Solar Roofs Initiative will create 15,000 new jobs for the Golden state.[x]
- According to the Center for Energy, Resources and Economic Sustainability at the University of California, Berkeley, California's energy-efficiency policies created nearly 1.5 million jobs from 1977 to 2007, while eliminating fewer than 25,000.[xi]
- The UCS concluded that Washington's Initiative 937 (I-937), a 15% by 2020 RPS, would create 2.6 times more jobs than fossil fuels, resulting in a net increase of 1,230 jobs by 2025 for the state.[xii]
- In a report for the ASES, Roger Bezdek found that Ohio created over 500,000 total jobs in RE and EE industries in 2006.[xiii]
- A study by Global Insight Inc. for the Renewable Energy Trust reports that the clean energy sector currently provides over 14,000 jobs in Massachusetts, and will soon become the 10th largest sector in the state.[xiv]
- Environment California said investing in the CAP & PERI green recovery program would bring more than 235,000 jobs and $12.7 billion in investments in California.[xv]

- In 2007, new tower, blade, turbine and assembly plants were announced for Arkansas, Colorado, Iowa, North Carolina, New York, and Oklahoma, which is expected to create 6,000 jobs.[xvi]

International

- According to the Worldwatch Institute, in 2006 there were 2.3 million people working directly or indirectly in RE industries around the world. The wind power industry employed about 300,000 people, the solar photovoltaic (PV) sector accounted for an estimated 170,000 jobs, and the solar thermal industry, at least 624,000. More than 1 million jobs were found in the biomass and biofuels sector.[xvii]
- According to the European Union Commission on Monitoring and Modeling Initiative on Targets for Renewable Energy, net employment growth in the **European Union** is projected to increase to 950,000 under current policies, and up to 1,660,000 under the Advanced Renewable Strategy of meeting 22.1% of energy demand with RE by 2010.[xviii]
- The Danish Wind Energy Association reports that wind energy created over 20,000 jobs in **Denmark**, supplied 20% of their electricity in 2004 and will supply 25% by 2008.[xix]
- According to the ASES-Bezdek report, RE employed over 214,000 people in **Germany** in 2006, 64,000 of whom are employed in the wind industry, according to the German Wind Energy Association.[xx]
- RE jobs in Germany shot up to 249,300 in 2007, up from 160,500 green jobs in Germany in 2004.[xxi]
- RenewableEnergyAccess.com reported that **Germany** recently amended its Renewable Energy Sources Act, increasing its RE targets from 20% to 27% by 2020, and to 45% by 2030.[xxii]
- Jobs in wind power, which accounts for 34% of green energy jobs in **Germany**, grew to 84,300 in 2007; in 2004, 63,000 people were employed in wind power. The booming solar sector saw jobs grow to 38,600 in 2007 up from 25,100 in 2004 as investment poured into PV production.[xxi]
- Erneuerbare Energien, a German Renewable Energies organization, predicted that if **Germany** met its [now outdated] goal of 20% by 2020, 500,000 people would be employed within the RE sector by 2020.[xxiii]
- The European Wind Energy Association reports that **Spain** currently employs about 35,000 people in its wind industry.[xxiv]
- **Spain** also has seen its renewables industry expand rapidly in recent years. The industry now employs some 89,000 people directly (mostly in wind power and PV) and another 99,000 indirectly.[xvii]
- In **Brazil**, the US Agency for International Development sponsored a program to train students from the poorest neighborhoods in building RE capacity. Nearly 12-15 million Brazilians live without electricity. The program has been a huge success--over 60% of the graduates from the 8-month long program now have jobs or are attending university full-time, and rural communities are benefiting from the new access to electricity.[xxv]
- **Brazil's** ethanol industry is said to employ about 300,000 workers.[xvii]
- In **Brazil**, 500,000 people are involved in materials collection activities for recycling (170,000 in aluminum can recycling alone).[xvii]
- In **Bangladesh**, Grameen Shakti has installed more than 100,000 solar home systems in rural communities in a few years-one of the fastest-growing solar PV programs in the world-and is aiming for 1 million by 2015, along with the creation of some 100,000 jobs for local youth and women as solar technicians and repair and maintenance specialists.[xvii]
- According to the Woods Hole Research Center, **India** could create some 900,000 jobs by 2025 in biomass gasification.[xvii]
- In **India's** capital New Delhi, the introduction of 6,100 Compressed Natural Gas buses by 2009 is expected to lead to the creation of 18,000 new jobs.[xvii]
- Solar Generation IV, a 2007 report by the European Photovoltaic Industry Association and Greenpeace International, projects under the best case scenario that by 2030 as many as 6.3 million jobs could be created by world-wide solar PV development, 2.1 million jobs in wind energy, and 12 million jobs in biofuels-related agriculture and industry.[xvii]
- According to a report by Worldwatch, greening the building industry in the European Union and the United States would create at least 2 million jobs by 2030.[xvii]

Wind

- According to the American Wind Energy Association, the United States currently has over 11,000 MW of installed wind energy capacity. Roger Bezdek concludes in his ASES report that in 2006 the wind industry created 16,000 direct jobs and 36,800 total jobs in 2006.[xxvi xxvii]

- According to a study by the Renewable Energy Policy Project, a national development of 50,000-70,000 MW of wind energy could potentially create 215,000-331,000 full time equivalent job/years of employment.[xxviii]
- Suzlon, one of the world's leading wind turbine manufacturers, currently employs more than 13,000 people directly – about 10,000 in India, and the remainder in China, Belgium, and the United States.[xvii]
- Global Wind Energy Outlook 2006 outlines scenarios for future worldwide wind energy development and projects global wind power employment to grow to as much as 2.1 million in 2030 and 2.8 million in 2050 under the advanced scenario.[xvii]
- According to the North Carolina Wind Working Group, every 100 MW of wind power installed provides 310 full-time equivalent (FTE) manufacturing jobs, 67 contracting and installation jobs, and 9.5 annual jobs in operation and maintenance.[xxix]
- Under the highest scenario, employment from offshore wind power in the United Kingdom would reach 76,000 additional full time jobs by 2020, compared to the 2003 level. The majority of these (some 64,000) would be in manufacturing and installation.[xxx]

Biofuels

- The ethanol industry produced 5 billion gallons in 2006, and created 163,034 jobs in all sectors of the economy during 2006 according to a report by the Renewable Fuels Association (RFA). Ethanol Across America reported the creation of 5,300 jobs in Minnesota, 5,187 jobs in Iowa and 3,000 jobs in Nebraska. [xxxi xxxii]
- According to the RFA, the increase in economic activity resulting from ongoing production and construction of new ethanol capacity supported the creation of 238,541 jobs in all sectors of the economy during 2007.[xxxiii]
- The US biodiesel industry is a new green industry that supports more than 21,000 jobs. It added $4 billion to the national economy in 2007.[xxxiv]
- Assuming biodiesel growth reaches 650 million gallons of annual production by 2015, the National Biodiesel Board estimates an additional 39,102 jobs will be created between 2006 and 2015.[xxxv]
- Biomass, which accounts for 39% of all RE jobs in Germany, employed 96,100 people in 2007, up from 56,800 in 2004.[xxi]

Geothermal

- The Geothermal Energy Association (GEA) reported 4,583 direct jobs in 2004, with an average salary of $40,000-$50,000.
- The Energy Information Association projected an increase of 2,455 MW in the geothermal industry by 2026, which would create 8,764 direct jobs and 21,910 total jobs by 2026, according to GEA.[xxxvi]
- The GEA identified 103 new projects underway in the United States that will result in the infusion of roughly $15 billion in capital investment in the western states, and create 7,000 permanent jobs and more than 25,000 person-years of construction and manufacturing employment.[xxxvii]

Solar

- Projected to become a $15 billion industry by 2020, the solar energy industry employed over 20,000 people in 2001, and is expected to employ 150,000 people in 25 years.[xxxviii]
- The Solar Energy Industries Association (SEIA) has a goal of supplying half of all new US electricity generation from the sun by 2025, creating more than 260,000 jobs by 2030.
- An economic study by Navigant Consulting, Inc., states that the extension of the 30 percent solar Investment Tax Credit (ITC) could result in enough direct, indirect, and induced activity to support 440,000 jobs. In addition, there would be an increase in domestic investment in the solar industry of $232 billion by 2016.[xxxix]
- A joint analysis by Greenpeace and European Photovoltaic Industries Association (EPIA) shows that if 205 gigawatts of PV systems are in place by 2020, solar energy could provide 2 million jobs worldwide.

Wave & Tidal

- Pat Cooke, Chairman of Able Engineering and head of the FreeFlow 69 project, estimates that a 1,000 MW wave and tidal power system could create up to 2,000 manufacturing and installation jobs and 100 permanent jobs.

Fossil Fuels

- According to data from the National Mining Association (NMA), jobs in the US coal mining industry have been decreasing steadily since 1985 (185,000 jobs in 1985, now down to 80,000 in 2005).[xl]
- The Coal-to-Liquid Coalition reports that a typical 10,000 barrel/day CTL plant creates 200 direct jobs on-site, 150 jobs at supporting coal mines and 2,800 indirect jobs throughout the region.

- According to NaturalGas.org, natural gas provides the United States with about a quarter of our energy. Data from the Department of Labor shows that distribution of natural gas employed 106,400 people in 2006.
- UCS estimates that requiring automakers to meet a fleet-wide average of 35 mpg by 2018 will create 241,000 additional jobs nationwide by 2020, and increase jobs in the automotive sector alone by 23,900. Such a requirement would also save consumers $37 billion in 2020 alone and cut national oil use by 1.6 million barrels per day by 2020.[xli]
- According to Worldwatch Institute, US coal output rose by almost one third during the past two decades, yet employment has been cut in half.[xvii]

Nuclear

- According to the Nuclear Energy Institute, a 1,000 MW nuclear plant creates 400-700 permanent jobs. Building a new nuclear plant would result in the creation of 1,400 to 1,800 jobs during construction.[xlii]

Green Collar Jobs Legislation

- The Green Jobs Act of 2007 was passed as part of the Energy Independence and Security Act on December 19, 2007, establishing a RE and EE Worker Training Program, a National Research Program to track energy-related workforce trends, State and National Energy Training Partnership Programs, and Pathways Out of Poverty Demonstration Programs. Authorized at $125 million a year, the program would be administered by the US Department of Labor. The program has not been funded.
- An economic study issued in September 2008 by Navigant Consulting, Inc., shows that more than 1.2 million employment opportunities, including 440,000 permanent jobs, and $232 billion in investment would be supported in the United States by the solar energy sector alone through 2016 if Congress extended the solar investment tax credit for eight years. (The extension was signed by the President on October 3, 2008, as part of the Emergency Economic Stabilization Act of 2008). Solar energy manufacturing and installation jobs are spread across the United States. The states that would see the greatest economic boom from an extended tax credit are California, Florida, Arizona, New Mexico, Nevada, New Jersey, Massachusetts, New York, Oregon, and Washington. Also, Pennsylvania, Michigan, Ohio and the rest of the Great Lakes region would benefit significantly from an expansion of the solar industry, an area hard-hit by layoffs in the automotive and traditional manufacturing industries.[xliii]
- Steven Nadel, ACEEE executive director, said extending the energy efficiency tax incentive provisions would add roughly 15,000 jobs to the US economy, considering both added jobs in the energy efficiency and service industries and lost jobs in the traditional energy industries.[xliv]

Authors: Jasmy Methipara, Amy Sauer, Chrissy Elles, and Fredric Beck
Editor: Carol Werner

Environmental and Energy Study Institute
1112 16th Street, NW, Suite 300
Washington, DC 20036
(202) 628-1400
www.eesi.org

The Environmental and Energy Study Institute (EESI) is a non-profit organization that works at the nexus of policy and innovation to promote environmentally sustainable societies. EESI was founded in 1984 by a bipartisan group of Congressional Members dedicated to finding environmental and energy solutions. EESI provides credible, timely information and innovative policy ideas through coalition building, media outreach, publications, briefings, workshops and task forces on the issues of energy efficiency and renewable energy, transportation, smart growth, agriculture and global climate change.

[i] *Economic and Jobs Impacts of the Renewable Energy and Energy Efficiency Industries: U.S. and Ohio,* Roger H. Bezdek of Management Information Services Inc. for American Solar Energy Society, July 2007
http://www.ases.org/images/stories/ASES-JobsReport-Final.pdf
[ii] *Cashing in on Clean Energy National Analysis,* Union of Concerned Scientists, July 2007
http://www.ucsusa.org/clean_energy/clean_energy_policies/cashing-in.html
[iii] *Putting Renewables to Work: How Many Jobs can the Clean Energy Industry Generate,* Renewable and Appropriate Energy Laboratories, April 2004
http://rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf
[iv] *Green Recovery A Program to Create Good Jobs and Start Building a Low-Carbon Economy,* CAP & PERI 2008
http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf
[v] *Current and Potential Green Jobs in the U.S. Economy,* United States Council of Mayors 2008
http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf
[vi] *Opportunity on the Horizon: Photovoltaics in Texas,* IC2 Institute, University of Texas- Austin, June 2007
http://www.utexas.edu/ati/cei/documents/TexasSolarOpportunity2007.pdf
[vii] *Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demands,* American Council for an Energy Efficient Economy, June 2007
http://aceee.org/pubs/e072.pdf?CFID=3210756&CFTOKEN=93870672
[viii] *Governor Crist Signs Executive Orders to Reduce Greenhouse Gas Emissions,* Governor Charlie Crist Press Release, July 16 2007
http://www.flgov.org/release/9230
[ix] *Renewable Energy and Jobs: Employment Impacts of Developing Markets for Renewables in California,* Environment California Research and Policy Institute, July 2003
http://www.environmentcalifornia.org/uploads/OW/aa/OWaa2RaedlfHwQOWbxKd5w/Renewable_Energy_and_Jobs.pdf
[x] *The California Solar Initiative: A monumental step to a million solar roofs,* Environment California, March 2007
http://www.environmentcalifornia.org/newsroom/energy/energy-program-news/the-california-solar-initiative-a-monumental-step-to-a-million-solar-roofs
[xi] *Energy Efficiency, Innovation, and Job Creation in California,* Center for Energy, Resources and Economic Sustainability at the University of California, Berkeley, October 20, 2008
http://are.berkeley.edu/~dwrh/CERES_Web/Docs/UCB%20Energy%20Innovation%20and%20Job%20Creation%2010-20-08.pdf
[xii] *The Washington Clean Energy Initiative: Effects of I-937 on Consumers, Jobs & the Economy,* Union of Concerned Scientists, October 2006
http://www.ucsusa.org/assets/documents/clean_energy/Washington-I-937-Report-Final.pdf
[xiii] *Economic and Jobs Impacts of the Renewable Energy and Energy Efficiency Industries: U.S. and Ohio,* Roger H. Bezdek of Management Information Services Inc. for American Solar Energy Society, July 2007
http://www.ases.org/jobs_report.pdf
[xiv] *Massachusetts Clean Energy Industry Census,* Massachusetts Technology Collaborative, Renewable Energy Trust, August 2007
http://www.masstech.org/Clean-Energy-Census-Report-2007.pdf
[xv] *Green Investment will yield 2 million jobs in two years* 2008
http://www.environmentcalifornia.org/newsroom/energy/energy-program-news/green-investment-will-yield-two-million-jobs-in-two-years
[xvi] *The Difference Wind Makes,* AWEA 2007
http://www.awea.org/pubs/factsheets/The_Difference_Wind_Makes.pdf
[xvii] *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World,* Worldwatch Institute2008
http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf
[xviii] *Meeting the Targets and Putting Renewables to Work- FLYER,* EU Commission on Monitoring and Modeling Initiative on Targets for Renewable Energy (MITRE)
http://mitre.energyprojects.net/
[xix] *Denmark- Wind Energy Hub,* Danish Wind Energy Association, 2004
http://www.windpower.org/media(207,1033)/wind_power_hub_pamphlet.pdf
[xx] *A Clean Issue- Wind Energy in Germany,* German Wind Energy Association, May 2006
http://www.wind-energie.de/fileadmin/dokumente/English/Broschueren/BWEImageEngl_2006.pdf
[xxi] *Renewable Energy Jobs Soar in Germany,* 2008 - RenewableEnergyWorld.com
http://www.renewableenergyworld.com/rea/news/story?id=52089
[xxii] *Germany Upholds Groundbreaking Renewable Energy Law,* RenewableEnergyAccess.com, July 6, 2007
http://www.renewableenergyaccess.com/rea/news/story?id=49250
[xxiii] *Data & Facts concerning renewable energy sources in Germany,* Erneuerbare Energien ("Renewable Energies"), October 2006
http://www.unendlich-viel-energie.de/index.php?id=282
[xxiv] *Economics of Wind Energy,* European Wind Energy Association, 2007
http://www.ewea.org/index.php?id=201
[xxv] *Success Story: Training Youth for Energy Jobs,* USAID
http://www.usaid.gov/stories/brazil/ss_br_youthenergy.html

[xxvi] *Wind Energy Projects throughout the United States of America,* American Wind Energy Association, March 2007 http://www.awea.org/projects/

[xxvii] *Renewable Energy: Economic Powerhouse? New research suggests that industry growth could generate hundreds of thousands of jobs for U.S. workers,* Table 1, Solar Today, July/August 2007 http://www.solartoday.org/2007/july_aug07/economic_powerhouse.htm

[xxviii] *Wind Turbine Development, Location of Manufacturing Activity,* Renewable Energy Policy Project, September 2004 http://www.crest.org/articles/static/1/binaries/WindLocator.pdf

[xxix] *Benefitting North Carolina Communities with Offshore Wind Farms,* North Carolina Coastal Wind Working Group http://www.repp.org/articles/static/1/binaries/NC_Economic_Development.pdf

[xxx] *Offshore Wind- Onshore jobs- A new Industry for Britain* 2004 http://www.greenpeace.org.uk/MultimediaFiles/Live/FullReport/6702.pdf

[xxxi] *Contribution of the Ethanol Industry to the Economy of the United States,* LEGC for Renewable Fuels Association, February 2007 http://www.ethanolrfa.org/objects/documents/2006_ethanol_economic_contribution.pdf

[xxxii] *Economic Impacts of Ethanol Production,* Ethanol Across America, Issue Brief Spring 2006 http://www.ethanolacrossamerica.net/CFDC_EconImpact.pdf

[xxxiii] *Hearing on Gas Prices and Vehicle Technology Testimony of Bob Dinneen President & CEO,* Renewable Fuels Association February 14,2008 http://www.ethanolrfa.org/objects/documents/1523/dinneen_house_approps_ew_2-14-08.pdf

[xxxiv] Biodiesel, A Sustainable Choice National Biodiesel Board 2008 http://www.biodiesel.org/resources/sustainability/pdfs/brochureSustainabilityfinal_0708.pdf

[xxxv] *House Subcommittee on Energy and Air Quality "Alternative Transportation Fuels: Overview",* Testimony by Scott Hughs, Director of Governmental Affairs, National Biodiesel Board, April 2007 http://www.biodiesel.org/resources/PR_supporting_docs/20070418_House%20Energy%20Subcmte%20Hrg%20on%20Alt%20Transport%20Fuels%20041807%20_2_.pdf

[xxxvi] *All About Geothermal Energy- Employment,* Geothermal Energy Association, September 2005 http://www.geo-energy.org/aboutGE/employment.asp

[xxxvii] *Geothermal Energy Growth Continues,* Geothermal Energy Association August 2008 http://geo-energy.org//publications/pressReleases/Geothermal%20Update%20Release%20August%207%202008.pdf

[xxxviii] *Solar Electric Power: The US Photovoltaic Industry Roadmap,* May 2001 http://www.sandia.gov/pv/docs/PDF/PV_Road_Map.pdf

[xxxix] *Economic Impacts of Extending Federal Solar Tax Credits,* Navigant Consulting, Inc., September 15, 2008 http://seia.org/galleries/pdf/Navigant%20Consulting%20Report%209.15.08.pdf

[xl] *Mining Industry Employment in the United States by Sector 1985-2005,* National Mining Association, December 2005 http://www.nma.org/pdf/e_sector.pdf

[xli] *Creating Jobs, Saving Energy and Protecting the Environment: An Analysis of the Potential Impacts of Investing in Efficient Cars & Trucks, a 2007 update,* Union of Concerned Scientists, June 2007 http://www.ucsusa.org/news/press_release/raising-fuel-economy-0045.html

[xlii] *Nuclear Statistics: Nuclear Power Plant Contributions to State & Local Economies,* Nuclear Energy Institute, updated January 2007 http://www.nei.org/index.asp?catnum=3&catid=1525

[xliii] *Economic Impacts of Tax Credit Expiration* American Wind Energy Association (AWEA) and the Solar Energy Research and Education Foundation (SEREF) September 15, 2008 http://www.awea.org/newsroom/pdf/Tax_Credit_Impact.pdf

[xliv] Renewable Energy Tax Package Will Save Consumers Money, Boost Economy, Create Jobs, Says Business-Consumer Coalition March 4, 2008 http://www.ucsusa.org/news/press_release/renewable-energy-tax-package-0099.html